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Vein Steak Differences in Strip Loins of Heifers Due to Mutation of the Myostatin Gene

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Summary

Strip loins from heifers with variations of the myostatin gene; 19 homozygous dominant (Angus), 20 heterozygous dominant (Angus x Piedmontese), and 20 homozygous recessive (Piedmontese) were studied. Strip loins were cut into 1-inch thick steaks and total number of steaks and number of steaks with Gluteus medius (often called vein steaks) were recorded. Strip loins from heterozygous dominant heifers had a greater number of non-vein steaks and decreased percentage of vein steaks compared to homozygous dominant and homozygous recessive samples. Differences in percentage of vein steaks were inconsistent and showed no meaningful pattern.

Introduction

Piedmontese cattle possess a recessive myostatin gene mutation that is a regulator of myogenesis (muscle growth) and leads to an increase in muscle mass due to increase muscle fiber number (hyperplasia). Cattle that are homozygous recessive for the myostatin gene have approximately twice the number of muscle fibers when compared to conventionally produced cattle (Kambadur, et al., *Genome Research*, 1997). Within heterozygous dominant cattle the myostatin allele is known as “partially recessive” and some noticeable differences in muscularity are observed (Kambadur, et al., *Genome Research*, 1997).

Toward the posterior end of the strip loin the *Gluteus medius* increases in size while the *Longissimus*

lumborum decreases in size and narrows. Strip loin steaks that contain the *Gluteus medius* also include a piece of connective tissue separating the *Gluteus medius* from the *Longissimus lumborum*. These steaks, known as vein steaks (Figure 1), are lower in value and have decreased tenderness compared to strip steaks without the *Gluteus medius*. Therefore, this study was conducted to compare amount and musculature differences within the strip loin of heifers due to the inactive myostatin mutation.

Procedure

Yearling heifers were divided into categories based on the myostatin gene that each animal possessed. Fifty-nine heifers were studied with 19 identified as homozygous dominant (Angus) for the myostatin allele (active myostatin gene), 20 were carriers (Angus x Piedmontese) of heterozygous allele (partially recessive myostatin gene), and 20 homozygous recessive (mutated myostatin gene; Piedmontese). Genotypes of heifers were confirmed using DNA testing. Heifers were delivered to the University of Nebraska–Lincoln Agricultural Research and Development Center

(ARDC) Research Feedlot and individually fed a common finishing diet for 191 days using Calan electronic gates. Cattle received no implants or feed additives to fulfill the requirements of an all-natural feeding program. Cattle were harvested and at three days postmortem strip loins were collected from the left side of carcasses. Strip loins were measured for loin weight, loin length, sirloin face width, rib face width, sirloin tail length, rib tail length, and fat thickness at the rib face prior to loins being fabricated. Strip loins were then cut into 1-inch thick steaks where total number of steaks, total number of vein steaks (those containing the *Gluteus medius*), total number of non-vein steaks, and weight of each steak were recorded.

Data were analyzed within a completely randomized design using ANOVA in PROC GLM in SAS (Version 9.2) (SAS Institute, Inc., Cary, N.C.) with the fixed effects being the different myostatin mutations and random effects was animal used. Separation of means was determined using LS MEANS and DIFF LINES options of SAS, with significance determined at $P \leq 0.05$.

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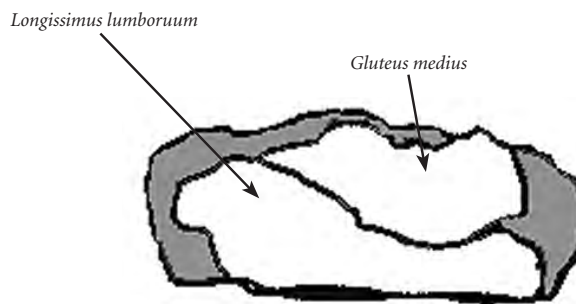


Figure 1. Illustration showing vein steak from posterior end of strip loin.

Results

With increasing copies of the recessive gene for myostatin, fat thickness (Table 1) decreased ($P < 0.001$). Homozygous recessive heifers yielded shorter loins ($P < 0.001$) and possessed a wider rib face ($P < 0.001$) compared to strip loins genotyped as homozygous dominant and heterozygous dominant. There were no differences for overall loin weight, sirloin face width, sirloin tail length, and rib tail length.

When total number of steaks were compared (Table 2) strip loins from homozygous recessive heifers yielded fewer total steaks ($P < 0.001$) compared to heterozygous dominant, which was expected as they were shorter in length. The strip loins from heterozygous dominant heifers had a greater number of non-vein steaks ($P = 0.002$), and a lower percentage of vein steaks ($P = 0.01$) compared to homozygous dominant and homozygous recessive. The differences observed in percent vein steaks was inconsistent across genotypes and showed no meaningful patterns. Overall mean steak weight, total weight of vein steaks, average steak weight, and percent weight of vein steaks did not differ among the genotypes.

Table 1. Heifer dimensional measurements of strip loin from cattle MM, Mm, or mm genotype of the myostatin gene.

Measurements	Number of Inactive Myostatin Alleles			SEM	P-value
	MM	Mm	mm		
Fat Thickness (in)	0.55 ^a	0.32 ^b	0.19 ^c	0.033	< 0.001
Loin Weight (kg)	6.62	6.77	6.59	0.188	0.77
Loin Length (in)	15.81 ^a	15.80 ^a	14.74 ^b	0.193	< 0.001
Sirloin Face Width (in)	9.97	9.68	9.96	0.116	0.13
Rib Face Width (in)	7.46 ^b	7.75 ^b	8.41 ^a	0.123	< 0.001
Sirloin Tail Length (in)	2.95	3.08	1.86	0.400	0.06
Rib Tail Length (in)	1.18	1.25	1.17	0.046	0.39

^{abc}Means with different superscripts within the same row are considered different $P \leq 0.05$.

¹Myostatin: homozygous active (MM), heterozygous partially recessive (Mm), and homozygous recessive inactive (mm).

Table 2. Heifer number, weight, and proportion of vein steaks from strip loins of cattle MM, Mm, or mm genotype of the myostatin gene.

Steak Trait	Number of Inactive Myostatin Alleles			SEM	P-value
	MM	Mm	mm		
Number of Loins Analyzed	19	20	20		
Total Steaks	12.63 ^{ab}	13.05 ^a	12.40 ^b	0.177	0.03
Number Vein Steaks	4.10	3.70	3.85	0.132	0.09
Non-Vein Steaks	8.53 ^b	9.35 ^a	8.85 ^b	0.179	0.002
Average Steak Weight (g)	514.91	497.77	506.09	11.233	0.55
% of Vein Steaks in Loin	32.47 ^a	28.32 ^b	31.17 ^a	1.011	0.01
Combined Weight of Steaks (g)	6490.16	6513.00	6284.40	157.350	0.52
Total Weight of Vein Steaks (g)	2123.68	1996.00	1888.80	79.789	0.12
% Weight of Vein Steaks	32.55	30.73	30.32	1.089	0.31

^{abc}Means with different superscripts within the same row are considered different $P \leq 0.05$.

¹Myostatin: homozygous active (MM), heterozygous partially recessive (Mm), and homozygous recessive inactive (mm).

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